Development of new synthetic methodologies for metal nanoparticle/MOF composites

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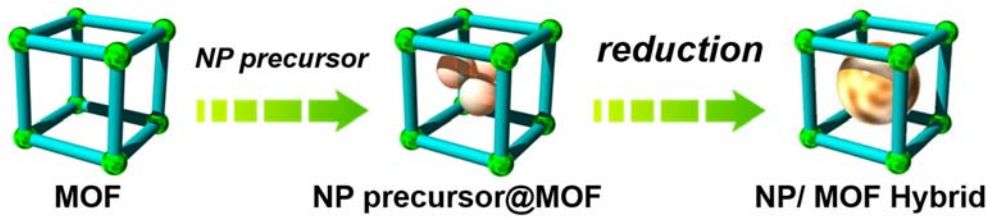
Metal-organic frameworks (MOFs) or porous coordination polymers (PCPs) are new types of porous materials composed of metal ions and organic ligands. Unlike to conventional porous materials such as zeolite and mesoporous silica, their porous properties can be more easily designed by judicious choice of metal ions and organic linkers[1]. Until now, countless numbers of MOFs have been synthesized as host materials not only for gas molecules[2] but also for other bigger compounds such as organic dyes[3], polymers[4], metal nanoparticles[5] and so on to obtain functional composites.

Among various kinds of composites with MOFs, the hybrids with metal nanoparticles have attracted great attention over the years because of their high catalytic activities or unique plasmonic propeties. Typically, metal NPs were synthesized by the reduction of metal NP precursors inside MOF pores with H_2 gas or $NaBH_4$ aqueous solution. Especially, gas phase reduction is advantageous from the point of homogeneity; the gas would easily spread over the MOF pores for the following reduction. Actually, many kinds of metal NPs-MOF hybrids have been synthesized with H_2 gas[6]. However, precise or perfect control of metal nanoparticle generation inside MOFs are still not easy.

In this presentation, I would introduce our recent examples[7] aiming for the precise control of metal nanoparticle generation inside MOFs. Their syntheses and functionalities would be discussed in detail.



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